

BOUNDARY-LAYER METEOROLOGY

UNIVERSITY OF HAWAII LIBRARY

LIBRARY USE ONLY



# BOUNDARY-LAYER METEOROLOGY

*An International Journal of Physical and Biological Processes  
in the Atmospheric Boundary Layer*

VOLUME 5 (1973-1974)



D. REIDEL PUBLISHING COMPANY

DORDRECHT - HOLLAND / BOSTON - U.S.A.

# BOUNDARY-LAYER METEOROLOGY

in the Atmospheric Boundary Layer  
in the Atmospheric Boundary Layer

VOLUME FOUR

All Rights Reserved

Copyright © 1974 by D. Reidel Publishing Company, Dordrecht, Holland  
No part of this book may be reproduced in any form, by print, photoprint, microfilm,  
or any other means, without written permission from the publisher

Printed in The Netherlands by D. Reidel, Dordrecht

## EDITOR:

R. E. MUNN, Atmospheric Environment Service, 4905 Dufferin Street, Downsview,  
Ont., Canada

## EDITORIAL BOARD:

- |   |   |
|---|---|
| I. A. Balogun, <i>Lagos State, Nigeria</i>                      | M. Miyake, <i>Vancouver, B.C., Canada</i>           |
| P. Barry, <i>Chalk River, Ont., Canada</i>                      | A. S. Monin, <i>Moscow, U.S.S.R.</i>                |
| A. Baumgartner, <i>München, West Germany</i>                    | D. H. Pack, <i>Silver Spring, Md., U.S.A.</i>       |
| M. E. Berlyand, <i>Leningrad, U.S.S.R.</i>                      | H. A. Panofsky, <i>University Park, Pa., U.S.A.</i> |
| T. J. Chandler, <i>London, England</i>                          | J. R. Philip, <i>Canberra City, Australia</i>       |
| R. J. Charlson, <i>Seattle, Wash., U.S.A.</i>                   | G. D. Robinson, <i>Hartford, Conn., U.S.A.</i>      |
| K. T. C. Cheng, <i>Yangming Shan, Taiwan, Republic of China</i> | R. Roth, <i>München, West Germany</i>               |
| A. G. Davenport, <i>London, Ont., Canada</i>                    | F. H. Schmidt, <i>De Bilt, The Netherlands</i>      |
| M. Estoque, <i>Coral Gables, Fla., U.S.A.</i>                   | T. Sekiguti, <i>Tokyo, Japan</i>                    |
| H. W. Georgii, <i>Frankfurt-am-Main, West Germany</i>           | V. P. Subrahmanyam, <i>Waltair, India</i>           |
| L. Hasse, <i>Hamburg, West Germany</i>                          | W. Swinbank, <i>Boulder, Colo., U.S.A.</i>          |
| U. Högeström, <i>Uppsala, Sweden</i>                            | K. Takeuchi, <i>Osaka, Japan</i>                    |
| E. Inoue, <i>Tokyo, Japan</i>                                   | P. A. Taylor, <i>Southampton, England</i>           |
| H. E. Landsberg, <i>College Park, Md., U.S.A.</i>               | R. J. Taylor, <i>Aspendale, Australia</i>           |
| E. R. Lemon, <i>Ithaca, N.Y., U.S.A.</i>                        | J. Tomlain, <i>Bratislava, Czechoslovakia</i>       |
| H. H. Lettau, <i>Madison, Wis., U.S.A.</i>                      | E. Truhlar, <i>Toronto, Ont., Canada</i>            |
|   | P. Ulriksen, <i>Santiago, Chile</i>                 |





# TABLE OF CONTENTS

## ARTICLES

BALDWIN, LIONEL V. and GEAROLD R. JOHNSON / An Estimate of Space-Time Correlations	373
BRADLEY, E. F., <i>see</i> Wooding, R. A. <i>et al.</i>	
*BROWAND, F. K. and C. D. WINANT / Laboratory Observations of Shear-Layer Instability in a Stratified Fluid	67
CAUCHEY, S. J. and R. RAYMENT / High-Frequency Temperature Fluctuations in the Atmospheric Boundary Layer	489
CORCOS, G., <i>see</i> Delisi, D. P.	
CSANADY, G. T., <i>see</i> Venkatesh, S.	
DAVIES, JOHN A., <i>see</i> McCaughey, John H.	
DEACON, E. L. / Geostrophic Drag Coefficients	321
DEARDORFF, J. W. / Differences Between Eddy Coefficients for Instantaneous and Continuous Vertical Diffusion Into the Neutral Surface Layer	451
*DELISI, D. P. and G. CORCOS / A Study of Internal Waves in a Wind Tunnel	121
DESJARDINS, R. L. and E. R. LEMON / Limitations of an Eddy-Correlation Technique for the Determination of the Carbon Dioxide and Sensible Heat Fluxes	475
*EMMANUEL, C. B. / Richardson Number Profiles Through Shear Instability Wave Regions Observed in the Lower Planetary Boundary Layer	19
ESTOQUE, M. A., <i>see</i> Gutman, D. P. <i>et al.</i>	
*GAGE, KENNETH S. / Linear Viscous Stability Theory for Stably Stratified Shear Flow: A Review	3
GODEV, N., <i>see</i> Yordanov, D.	
GOSSARD, E. E., <i>see</i> Hooke, W. H. <i>et al.</i>	
GUTMAN, D. P., K. E. TORRANCE, and M. A. ESTOQUE / Use of the Numerical Method of Estoque and Bhumralkar for the Planetary Boundary Layer	341
HALL, F. F., Jr., <i>see</i> Hooke, W. H. <i>et al.</i>	
HARRISON, A. W. / Atmospheric Thermal Emission 2.5–4.2 $\mu$	365
HÖGSTRÖM, ULF, <i>see</i> Smedman-Högström, Ann-Sofi	
HOLLAND, J., <i>see</i> Van Buijtenen, C. J. P. <i>et al.</i>	
*HOOKE, W. H., F. F. HALL, Jr., and E. E. GOSSARD / Observed Generation of an Atmospheric Gravity Wave by Shear Instability in the Mean Flow of the Planetary Boundary Layer	29

\* Entries marked with an asterisk belong to the IURCM Symposium Proceedings, Part II: 'Waves and Turbulence in Stable Layers and Their Effects on EM Propagation'.

HUANG, CHIN-HUA and EVERETT C. NICKERSON / Stratified Flow Over Non-Uniform Surface Conditions: Mixing-Length Model	395
*IYER, P. A. / Instabilities in Buoyancy-Driven Boundary-Layer Flows in a Stably Stratified Medium	53
JOHNSON, GEAROLD R., <i>see</i> Baldwin, Lionel V.	
*KOGAN, Z. N. and N. P. SHAKINA / Numerical Investigation of Internal Waves in Jet Streams Including Nonlinear Effects	79
LEMON, E. R., <i>see</i> Desjardins, R. L.	
*LONG, ROBERT R. / Some Properties of Horizontally Homogeneous, Statistically Steady Turbulence in a Stratified Fluid	67
MARSHALL, J. K., <i>see</i> Wooding, R. A. <i>et al.</i>	
*MASLOWE, S. A. / Finite-Amplitude Kelvin-Helmholtz Billows	43
MCCAUGHEY, JOHN H. and JOHN A. DAVIES / Diurnal Variation in Net Radiation Depletion Within a Corn Crop	505
*MCEWAN / Interactions Between Internal Gravity Waves and Their Traumatic Effect on a Continuous Stratification	159
NICKERSON, EVERETT C., <i>see</i> Huang, Chin-Hua	
PANOFSKY, H. A., <i>see</i> Ropelewski, C. F. <i>et al.</i>	
*PAO, YIH-HO / Measurements of Internal Waves and Turbulence in Two-Dimensional Stratified Shear Flows	177
RAYMENT, R. <i>see</i> Caughey, S. J.	
ROPELEWSKI, C. F., H. TENNEKES, and H. A. PANOFSKY / Horizontal Coherence of Wind Fluctuations	353
SEGINER, IDO / Aerodynamic Roughness of Vegetated Surfaces	383
*SHAKINA, N. P., <i>see</i> Kogan, Z. N.	
SHAW, R. H., R. H. SILVERSIDES, and G. W. THURTELL / Some Observations of Turbulence and Turbulent Transport Within and Above Plant Canopies	429
SHIRVAIKAR, V. V., <i>see</i> Sitaraman, V.	
SHONTING, DAVID H. / An Observation of Hot Air Downwelling over Pantelleria Island in the Strait of Sicily	347
SILVERSIDES, R. H., <i>see</i> Shaw, R. H. <i>et al.</i>	
SITARAMAN, V. and V. V. SHIRVAIKAR / Lagrangian Similarity Theory Applied to Diffusion in the Planetary Boundary Layer	419
SMEDMAN-HÖGSTRÖM, ANN-SOFI and ULF HÖGSTRÖM / The Marsta Micro-Meteorological Field Project. Profile Measurement System and Some Preliminary Data	259
TENNEKES, H., <i>see</i> Ropelewski, C. F. <i>et al.</i>	
*THORPE, S. A. / Turbulence in Stably Stratified Fluids: A Review of Laboratory Experiments	95
THURTELL, G. W., <i>see</i> Shaw, R. H. <i>et al.</i>	
TORRANCE, K. E., <i>see</i> Gutman, D. P. <i>et al.</i>	
VAN BUIJTENEN, C. J. P., J. HOLLAND, and D. VAN LEEUWEN / A Numerical Diffusion Model for Continuous Releases	275



VAN LEEUWEN, D., <i>see</i> Van Buijtenen, C. J. P. <i>et al.</i>	
VENKATESH, S. and G. T. CSANADY / A Baroclinic Planetary Boundary-Layer Model, and Its Application to the Wangara Data	459
WINANT, C. D., <i>see</i> Browand, F. K.	
WOODING, R. A., E. F. BRADLEY, and J. K. MARSHALL / Drag Due to Regular Arrays of Roughness Elements of Varying Geometry	285
YORDANOV, D. and N. GODEV / Parametrization of Orographical Effects in the Planetary Boundary Layer	309

#### \*Working Group Reports

I. <i>Chairman</i> : K. A. BROWNING / Capabilities of Radar, Sodar and Lidar for Measuring the Structure and Motion of the Stably Stratified Atmosphere	195
II. <i>Chairmen</i> : W. H. MUNK and J. D. WOODS / Remote Sensing of the Ocean	201
III. <i>Editor</i> : NIELS E. BUSCH / Turbulence Spectra at Scales Smaller than 1 Meter	211
IV. <i>Chairman</i> : A. R. MAHONEY / The Interaction Between Atmospheric Microstructure and Acoustic and Electromagnetic Waves	219
V. <i>Chairman</i> : RICHARD S. LINDZEN / Hydrodynamics of Stratified Fluids (The Applicability of Linear Theory)	227
VI. <i>Chairman</i> : C. J. READINGS / The Formation and Breakdown of Kelvin-Helmholtz Billows	233
VII. <i>Chairman</i> : HANS A. PANOFSKY / The Lower Atmosphere in Hydrostatically Stable Conditions	241
VIII. <i>Chairman</i> : KENNETH R. HARDY / On the Prediction of Turbulence in Baroclinic Zones	245
IX. <i>Chairman</i> : A. WATERMAN / Forward Scatter Propagation Measurements (Trans-Horizon and Line-of-Sight) Applied to Specific Forms of Instabilities in Layers	251

BOOK REVIEWS	379, 513
--------------	----------

ERRATUM	380
---------	-----

INDEX OF SUBJECTS	525
-------------------	-----

PUBLICATIONS RECEIVED	521
-----------------------	-----

